

STATE OF ALASKA DOT&PF

**MATERIAL SITE INVENTORY
STATUS & INSPECTION
REPORTS**

CENTRAL REGION

STERLING HIGHWAY

**PRIMARY ROUTE NO. 21
MILEPOST 37 (SEWARD WYE) TO 179.5 (HOMER)
&
SECONDARY ROUTE NOS. 414 & 430**

**Federal Project No. STP000S(823)
AKSAS Project No. 76149**

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July, 2015

STATEWIDE MATERIAL SITE INVENTORY

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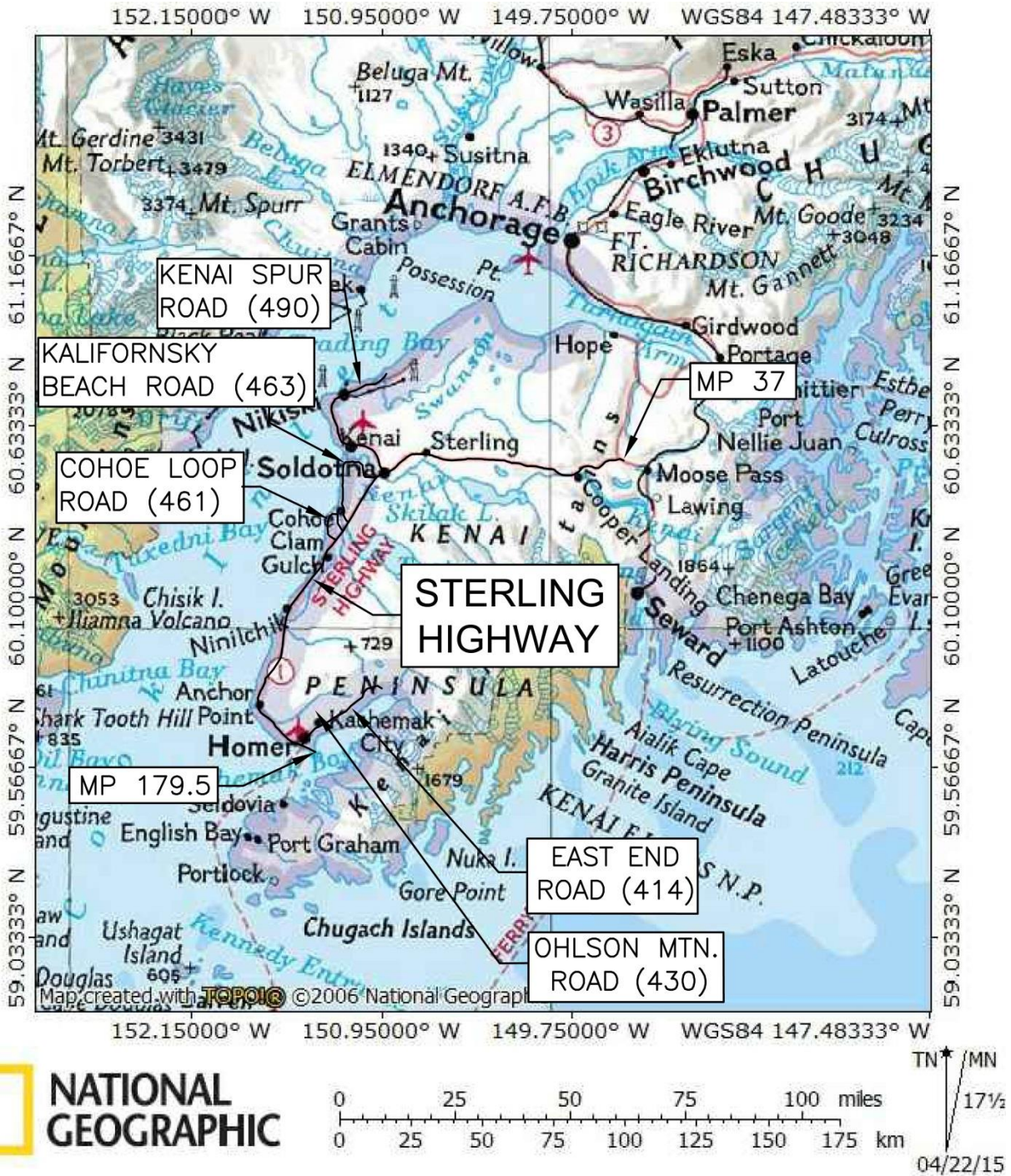
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STATUS REPORTS

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STERLING HIGHWAY

VICINITY MAP



STATE OF ALASKA DOT&PF STATEWIDE MATERIAL SITE INVENTORY

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STERLING HIGHWAY PRIMARY ROUTE NO. 21

1.0 MATERIAL SITE NUMBERING

Alaska Department of Transportation and Public Facilities (DOT&PF) material site numbers for Sterling Highway were assigned using the following format.

For primary route system coding, i.e. 21-1-001-1:

- The first two digits represent the Primary Federal Aid Route Number. For the Sterling Highway this number is 21.
- The third digit represents the control section of the route. For the Sterling Highway the section numbers are:
 1. Homer (MP 179) to Soldotna (MP 94.5)
 2. Soldotna (MP 94.5) to Seward Wye (MP 37)Section 2 includes the Kenai North Spur Highway (MP 0) to (MP 13)
- The 4th, 5th and 6th digits are the assigned site numbers for the Sterling Highway.
- The last digit is the region in which the site is located. For the Central Region the number is 1.

Using secondary route system coding, i.e. 430-001-1:

- The first three digits represent the Secondary Federal Aid Route Number, for East End Road this number is 430.
- The 4th, 5th and 6th digits are the assigned site number.
- The last digit is the region in which the site is located. For Central Region the number is 1.

2.0 MATERIAL SITE CLASSIFICATION

Material site classification and status were determined during the inventory and material site data for the sites along, and in the vicinity of, the Sterling Highway. Only sites with known locations and an assigned material site number were classified. Classification and status are current as of the date on the cover sheets of the Inspection and Status Reports, but both may have changed since that date. Therefore the reader is directed to DOT&PF ROW Central Region Material Site Inventory dated 6-18-2008 or Central Region Materials and ROW Sections for updates and current information. Criteria for determining classification and status for material sites along the Sterling Highway are outlined below.

CLASSIFICATION

- ACTIVE – Sites that DOT&PF apparently has an interest in. This can include active permits/contracts/right-of-ways that should have been closed but have not been. For example these may include right-of-way grants that are still authorized even though BLM has transferred the administration of a site. The 26 active sites along the Sterling Highway, East End Road, and Ohlson Mountain Road were further given the following status:
 - OPEN_ – 2 Sites
 - REMOVED – 3 Sites
 - DEPLETED_ – 2 Sites
 - POTENTIAL – 3 Sites
 - STATUS UNKNOWN_ – 16 Sites
- INACTIVE – Sites (with MS numbers) that DOT&PF apparently no longer has any interest in and/or are no longer available for extracting material. This may be due to relinquishment of the site by DOT&PF or closure by agencies. The 186 inactive sites were further given the following status:
 - CLOSED – 182 Sites
 - REMOVED – 1 Site
 - STATUS UNKNOWN – 3 Sites

STATUS

- OPEN – Two active sites along the Sterling Highway apparently had all the necessary permits to mine and were classified as OPEN. The open status will change over time and potential users should review the status before excavating the sites. They include two sites, MS 21-2-051-1 and MS 430-625-1, which are respectively Quartz Creek Pit and Ohlson Mountain Pit. Both had both a current DNR permit and a KPB prior existing use designation.
- CLOSED – Includes sites in which permits had expired, been terminated, or otherwise closed and no further consideration of the site was currently planned. There were 175 closed sites on the Sterling Highway and 5 on East End Road.
- REMOVED – Some active sites may not be material sites but sites for buildings and other infrastructure. The three sites on the Sterling Highway include MC 21-1-1853-1 (Ninilchik Maint. Station), MC 21-1-027-1 (Homer Maint. Station), and 21-1-293A-1 (East End Road Maintenance Site).

One inactive site, MS 21-1-065-1, was a commercial site, never a DOT&PF site and the number was reportedly assigned to track lab data.

- DEPLETED – Sites that are apparently depleted of suitable materials. This included MS 21-1-064-1 in which no suitable material was found. And MS 21-1-264-1 where it appeared that the identified suitable material had gone over the bluff due to erosion or was outside the site.
- POTENTIAL – Sites that are currently unavailable for various reasons but appear to still contain useable material and DOT&PF may still have an interest in them. These include sites on the Kenai National Wildlife Refuge and the Chugach National Forest on which long term permits have not been retained by DOT&PF and DNR Master Material Sites that DOT&PF does not have current permits.
- STATUS UNKNOWN – ACTIVE sites with unclear status include sites that had expired DNR or BLM contracts but the case file abstract indicates they are not closed: sites that had current DNR contracts but no KPB conditional use permits; sites that have an existing user designation from the KPB but no current DNR contract and sites that had different status occurring in different parts of the site i.e. MS 21-1-228-1 at Kasilof.

Three sites were classified as INACTIVE-STATUS UNKNOWN: MS 21-1-291-1 (it appears there may be some title issues to clean up); MS 21-2-013-1 (DOT&PF has 2 parcels in a subdivision); and MS 21-2-236-1 (DOT&PF may still have an active BLM right-of-way that should be relinquished if appropriate).

3.0 GEOLOGIC SETTING

The following information is general in nature and is intended to provide those who are unfamiliar with the area with a general description of the geology, and how it relates to material sites. This information is not intended to be complete. More detailed investigations should be performed before decisions are made on individual material sites.

3.1 Location and History

The Sterling Highway is part of Alaska Route 1. It leads west from Tern Lake to Soldotna, paralleling the Kenai River, at which point it turns south to follow the eastern shore of Cook Inlet. It is the only major highway in the western and central Kenai Peninsula, and most of the population of the Kenai Peninsula Borough lives near it. The southern end of the highway is at the tip of the Homer Spit, a sandbar extending five miles into Kachemak Bay. A ferry terminal here connects the road to the Alaska Marine Highway.

Mileposts along the Sterling Highway do not begin with zero. Instead, they begin with Mile 37, continuing the milepost numbering for the Seward Highway where the two highways intersect near Tern Lake. The 0 (zero) mile marker for the Seward Highway is at its terminus in downtown Seward at the intersection of 3rd Avenue and Railway Avenue. Thus, mileposts along the Sterling Highway reflect distance from Seward, which is not actually on the Sterling Highway.

At this time the actual length of the Sterling Highway is approximately 138.2 miles. The milepost distance is based on the actual mileposts along the road, between which the distance varies. The discrepancy between the actual distance and the milepost distance is due to straightening of the alignment during reconstruction projects without readjusting the mileposts.

Besides the Sterling Highway itself, there are approximately 1,350 miles of State maintained roads on the western Kenai Peninsula. This Sterling Highway report for Primary Route 21 includes material sites with the following secondary route designations:

- Secondary Route No. 414 - East End Road from Homer to the end of the road. (~21.8 miles in length).
- Secondary Route No. 430 - Ohlson Mountain Road from Skyline Drive East to end of road (~4.5 miles in length).

In addition, material sites for three secondary routes are included in separate report sections:

- Secondary Route No. 461 - Coho Loop Road from MP 114 on the Sterling Highway to MP 111 on the Sterling Highway (~15.3 miles in length).
- Secondary Route Nos. 463 - Kalifornsky Beach Road from MP 109 on the Sterling Highway to MP 96 on the Sterling Highway (~22.2 miles in length).
- Secondary Route No. 490 – Kenai Spur Highway from Sterling Highway to Beach Bay Road (~38.8 miles in length). Sites south of Milepost 13 use the Sterling Highway primary route designation 21 and to the north the Kenai Spur Highway second-

ary route designation 490. Material sites with the 490 designation are found throughout the North Kenai area, and do not necessarily lie along the Highway.

Material Sites south of Kachemak Bay, designated by both 21 and 404 route numbers are also provided in a separate report section.

- Secondary Route No. 404 – Seldovia Roads. There are about 35 miles of State maintained roads in the Seldovia area, with short roads and airports in Nanwalek (previously English Bay) and Port Graham.

There are a limited number of DOT&PF material sites that are open on the Kenai Peninsula. Much of the material for road construction and maintenance comes from commercial sources on private land.

As of the census of 2000, there were 49,700 people, 18,400 households, and 12,700 families residing in the Kenai Peninsula Borough. The peninsula includes several of the most populous towns in southern Alaska, including Seward on the Gulf of Alaska Coast, Soldotna (4,163), Kenai (6,942), along the Cook Inlet, and Homer (5,003), Kachemak (472) and Seldovia (255), along Kachemak Bay in addition to numerous smaller villages and settlements.

Small Villages and Settlements along the Sterling Highway		
Anchor Point	Funny River	Ninilchik
Clam Gulch	Halibut Cove	Point Possession
Cohoe	Happy Valley	Port Graham
Cooper Landing	Kalifornsky	Ridgeway
Diamond Ridge	Kasilof	Salamatof
Fox River	Nikiski	Seldovia Village
Fritz Creek	Nikolaevsk	Sterling

3.1.2 History

Native Alaskan peoples had lived and used the areas around the numerous rivers and streams for many thousands of years prior to the Russian establishment.

In 1786 the Russians built Fort Nikolaevskaia on the site of modern Kenai, being the first European settlement on the Alaskan mainland. Hostilities surfaced between the natives and settlers in 1797, culminating in an incident in which the Dena'ina attacked Fort St. Nicholas, later dubbed the battle of Kenai. In 1869, after the Alaska Purchase, the United States Army established a post called Fort Kenay but it was soon abandoned.

The first people to permanently stay in Ninilchik were Russian colonists who moved there from Kodiak Island in 1847 before the Alaska Purchase. In the 1940s, a number of homesteaders came to the area. In 1949, Berman Packing Company began fish canning operations at Ninilchik.

Coal was discovered near Homer in the 1890s. The Cook Inlet Coal Fields Company built a town, dock, coal mine, and a railroad at Homer. Coal mining in the area continued until World War II.

The establishment of shipping companies in the early 1900s broadened Kenai into a port city. Canning companies were established and helped fuel the commercial fishing boom that was the primary activity through the 1920s.

Kenai National Wildlife Refuge was first established as the Kenai National Moose Range in 1941 to protect moose. In 1980, the Alaska National Interest Lands Conservation Act (ANILCA) changed the name and purpose of the refuge. The refuge now exists to protect wildlife populations.

In 1940, homesteads were opened in the area. In 1947, after World War II, the United States government withdrew a number of townships along Cook Inlet and the lower Kenai River from the Kenai National Moose Range, opening up the area to settlement under the Homestead Act. After World War II, veterans were given priority in homesteading in this area and settlement began to grow.

In 1937, construction of the Kenai Airport began. The first dirt road from Anchorage was constructed in 1951; pavement would not arrive until 1956 with the construction of the Kenai Spur highway.

The precursor to the current Sterling Highway was built in the 1930s, connecting Cooper Landing to Kenai. It was not until 1950, however, that the Sterling and Seward highways connected Homer and the other western Kenai Peninsula communities to Anchorage.

Construction of the Kenai Spur Highway occurred in the 1950s, resulting in increased settlement. The Sterling Highway opened in the fall of 1950, and was named in honor of Hawley Sterling, an engineer of the Alaska Road Commission.

Oil was discovered at the nearby Swanson River area in 1957, this was the first major oil discovery in Alaska. In 1965, offshore oil discoveries in Cook Inlet caused a period of rapid growth giving the population and economy of the area another major boost.

In 1964, the Kenai Peninsula Borough government, and the Kenai Peninsula Borough School District were formed.

According to the KPB web page the Borough currently has one of the state's most diverse economies. Major industries include oil and gas, commercial fishing, tourism and logging. The oil and gas industry is composed of exploration, extraction, storage, processing/manufacturing, and transportation and accounts for approximately one-third of the labor force. Commercial harvest

and processing of fish in the borough traditionally includes: salmon, halibut, crab, shrimp, clams, scallops, herring, and various ground fish. Tourism is the fastest growing industry in the borough and the Kenai Peninsula Tourism Marketing Council enjoys widespread membership. The timber industry is an emerging part of the local economy with an automated lumber mill on the eastern peninsula and a large chipping operation located on the southern peninsula.

3.2 General Geology

Surficial materials along the Sterling Highway consist predominately of Pleistocene glacial tills, glaciofluvial, glacioestuarine, glaciolacustrine and recent fluvial deposits. The glacial deposits are comprised of tills that were amassed during the different stades of the Naptowne Glaciation.

1. Moosehorn Stade – Along the western side of the Kenai Mountains. Encountered in the Kenai-Soldotna Area and between Kasilof and Anchor Point.
2. The Killey Stade – Encountered east of Skilak Lake, Tustumena Lake and around Kachemak Bay. Also encountered along the North Kenai Spur near Nikiski.
3. Skilak Stade – Encountered around Skilak Lake and Kachemak Bay.
4. Elmendorf Stade – Encountered along the highway system only around Cooper Landing.

Glacial tills generally consist of silty sand and gravel with cobbles and boulders. They generally make poor borrow, generally becoming difficult to compact when wet or placed in wet locations.

There were glaciofluvial materials associated with outwash channels and plains as the Naptowne glaciation waxed and waned. The glaciofluvial materials are generally composed of sand and gravel with silt contents generally less than about 12 percent. This is the most common deposit for material sites, both DOT&PF and commercial sites.

Fluvial deposits consist of both active and inactive floodplain and terrace materials composed of sand and gravel with silt contents typically less than 10 percent. There have been a number of material sites on fluvial deposits in the past. They are less common today as land along the major waterways becomes more expensive.

Glaciolacustrine deposits near the eastern shore of Cook Inlet comprise deposits from a probable regional lake during maximum extent of the Moosehorn Stade and several smaller lakes as the glacier retreated. The glaciolacustrine deposits consist of well sorted and well stratified layers of clay, silt, and fine sands overlain by sand and gravels. These deposits are utilized for sources of material.

Glacioestuarine deposits are found on the Kalifornsky Glacioestuarine Terrace along Kalifornsky Beach Road.

Beach deposits have been mined in several locations north of Anchor Point. The beaches are at the base of steep sea walls and can be difficult to access. In the past both tide flats and material from sites on the Homer Spit have been mined. The material ranges from gravel to sand.

There are two bedrock complexes along the Sterling Highway. The first includes the rocks of the Valdez Group and the McHugh Complex in the Kenai Mountains and the second is the Kenai Group that underlies most of the lowlands to the west.

Bedrock along much of the route is part of the Valdez Group, a late Cretaceous flysch unit that is reportedly several thousand feet thick. The unit consists of sedimentary rocks including sandstones, siltstones and minor conglomerates. Along the Seward and Sterling Highway corridors on the Kenai Peninsula, these rocks have been intensely sheared and deformed. The rock has a prominent near-vertical foliation striking roughly parallel to the north-south valleys. The metamorphic bedrock appears to consist chiefly of dark gray to black cataclastic rocks composed of phyllonites and mylonites with pockets or “islands” of undeformed orthoquartzite, commonly referred to as greywacke. The orthoquartzite in these “islands” has been utilized for aggregate production along portions of the Seward Highway, including D-1 and asphalt aggregate. The cataclastic rocks contain black, soft, phyllitic material interlayered with material appearing to be fine-grained sandstone. However, experience indicates that much of this “sandstone appearing material” has apparently been deformed by shearing, re-cemented with calcite and consequently weakened. This cataclastic rock is generally highly degradable and not suitable for aggregate production. Wide shear zones composed almost entirely of soft phyllonites and mylonites have been observed in the valley bottoms.

The McHugh Complex is composed of a *mélange*, or “a mappable body of rock characterized by a lack of continuous bedding and the inclusion of fragments of rock of all sizes, contained in a fine-grained deformed matrix. A *mélange* typically consists of a jumble of large blocks of varied lithologies”. On the Kenai Peninsula the rock typically consists of fine-grained sandstones, siltstones, volcanics, chert and argillites. It occurs along the west side of the Kenai Mountains starting at about MP 57 west to MP 63. It can be observed in the valley walls and in some rock cuts along the river. It is quite suitable for common borrow. However, the rock is unsuitable for aggregate production, and even those parts that are of good quality are usually in areas where mining would be very difficult or impractical.

West of the Kenai Mountains, the Kenai Peninsula is underlain by rocks of the Tertiary Kenai Group. The Kenai Group consists of the Sterling, Beluga, and Tyonek Formations and Hemlock Conglomerate. These Tertiary rocks are typically poorly consolidated estuarine and nonmarine clastic sedimentary units. Coal seams are found throughout the units. Generally, they are poorly consolidated and break down into their constituent parts when weathered. They outcrop in the bluffs along Cook Inlet and are apparently subject to rapid erosion causing the bluff lines along Cook Inlet to retreat relatively rapidly. The two units that predominate along the bluffs on the Kenai Peninsula side of Cook Inlet are the Sterling and Tyonek Formations, both composed of massive sandstone, conglomeritic sandstone and interbedded siltstone and claystone. They are typically not found in places or on terrain where they can be readily mined and very few sites have been developed in this material.

Permafrost is typically found in isolated pockets in the mountains or under uninsulated areas north of Tustumena Lake and generally absent south of Tustumena Lake. Groundwater is generally shallow in areas along the rivers and in the peat bogs.

The corridor can be divided into the following material source areas.

1. Seward Wye to Junction w/east end of Skilak Loop Road MP 37 to MP 58
2. Junction w/east end of Skilak Loop Road to Moose River MP 58 to MP 82
3. Moose River to Coal Creek MP 82 to MP 105
4. Coal Creek to Clam Gulch MP 105 to MP 117
5. Clam Gulch to Anchor River MP 117 to MP 157
6. Anchor Point to End of Homer Spit MP 157 to MP 179.5
7. East End Road and Ohlson Road

3.3 Seward Wye to Junction w/east end of Skilak Loop Road MP 37 to MP 58

Between MP 37 at the Seward Wye and MP 58 at the junction with the east end of Skilak Loop Road, the Sterling Highway traverses through a steep walled glacial valley overlain by Elmen-dorf moraines and associated glaciofluvial deposits and recent fluvial deposits. The area is a popular recreation area and is becoming developed. It will be more difficult to acquire material sites in the area within the future.

Between the Wye and MP 45 at Kenai Lake, the road crossed floodplain deposits of Daves and Quartz Creek. A large site, MS 21-2-051-1 has been dedicated to provide construction materials for this area. Rock cuts also have provided much of the construction material and may provide more in the future.

From MP 45 to the Kenai River, the highway crosses bedrock knobs and ridges and several large alluvial fans. Rock cuts have provided most of the material for this section in the past. The alluvial fans have only occasionally been a source of material, even though they would make excellent sources.

From the Kenai River Bridge to MP 58 the highway follows the Kenai River and most of the past and present material sites have been on ice-contact, alluvial terrace and floodplain deposits. There are a series of large alluvial terraces near the Resurrection Trailhead at Schooner Bend (MP 53). Other terrace deposits can be found near the Resurrection River Parking Lot at MP 55 and MP 56. Alluvial fan deposits near the Fuller Creek Trailhead near MP 57 have also been mined in the past. It should be noted that many of these terrace deposits are covered by an extensive complex of archeological sites. Bedrock cuts are also available through this section. There have been also several material sites in the terrace deposits along Snug Harbor Road.

There is limited aggregate testing results for material in this segment. Laboratory test results from MS 21-2-051-1 show Los Angeles Abrasion losses of 14 to 17 percent, degradation values of 44 to 52 and NaSO₄ loss results of 0 to 2 percent. While this indicates the material in the Quartz Creek drainage may produce adequate material for crushed material such as D-1, the moderate degradation values may make it problematic for producing asphalt aggregate. The moderate degradation values may be a reflection of the weakness of the Valdez Group bedrock in the surrounding mountains. Silt contents typically range from 1 to 7 percent in this section of highway.

This segment of the highway crosses through Chugach National Forest and the Kenai National Wildlife Refuge. Only areas along Quartz Creek and around Cooper Landing are owned by the State of Alaska. DOT&PF typically cannot keep sites open between projects on Refuge or Forest Lands. DOT&PF presently has 2 active sites and a maintenance site along this section of the road.

3.4 Junction w/east end of Skilak Loop Road to Moose River MP 58 to MP 82

Between MP 58 and MP 82 the Sterling Highway crosses glacial moraines of the Skilak, Killey, and Moosehorn Stades of the Naptowne Glaciation. Major meltwater drainages occurred interspersed between these stades and formed glacial outwash deposits. All of the material sources along this segment of the highway lie in these glaciofluvial deposits.

Like the previous segment, there is limited aggregate testing results for material. Laboratory test results from MS 21-2-399-1 near Jean Lake show Los Angeles Abrasion losses of 14 to 21 percent, degradation values of 41 to 59 and NaSO₄ loss results of 0 to 1 percent. While this indicates the material in this segment may produce adequate material for crushed material such as D-1 the moderate degradation values may make it problematic for producing high quality asphalt aggregate. The moderate degradation values may be a reflection of the weakness of the Valdez Group and McHugh Complex bedrock in the mountains from when the glacier emerged.

These moraines consist of silt, sand, gravel, cobbles, and some sites may contain large boulders, typically mantled by 2 to 6 feet of loess. According to borehole logs found in the Material Site Data Files for sites located within this section of highway, silt content ranges from 4 to 10 percent. Silt content generally increases to the west.

This segment of the highway crosses through the Kenai National Wildlife Refuge. DOT&PF typically cannot keep sites open between projects on Refuge Lands, but has to reapply for each project.

3.5 Moose Creek to Coal Creek MP 82 to MP 105

Between MP 82 and MP 105 the highway traverses rolling hills as it follows the Kenai River to Soldotna and then south to Coal Creek. This area also includes the southern end of the Kenai Spur Highway between Soldotna and the City of Kenai. Between MP 82 and MP 93 near Soldotna the highway traverses glacial moraines and glaciofluvial deposits of the Moosehorn Stade. There are large areas of glacial outwash spread out throughout the moraines and most of the material sites are found on these deposits. There were some sites on fluvial deposits of the Kenai River.

Between MP 93 and 98 the highway traverses through Soldotna and crosses the Kenai River. There are meltwater deposits of the Killey and Skilak Stades along with modern fluvial deposits in the area. Then from MP 98 to 105 the highway parallels a meltwater channel of the Moosehorn Stade.

From the junction of the Kenai Spur Highway to MP 13 just beyond the City of Kenai, the Kenai Spur Highway crosses glaciofluvial deposits in braided outwash plains. Again the material sites are found primarily on the glaciofluvial deposits.

This entire area is developing and sources of gravel for DOT&PF are going to be harder to find. MS 21-2-401-1 is a large site near Scout Lake and lies on glaciofluvial deposits. There are numerous commercial sites in this area with DOT&PF becoming more dependent on them.

3.6 Coal Creek to Clam Gulch MP 105 to MP 117

Between MP 105 and MP 117, the road crosses outwash of the Killey Stade and alluvial deposits of Coal Creek, the Kasilof River, and Crooked Creek. All three of these drainages were major meltwater channels in the past. Kalifornsky Beach Road begins at Sterling Highway MP 109. Coho Loop Road begins in this section at MP 114 and terminates at MP 111.

The Sterling Highway crosses major meltwater drainages of the Killey Stade and Skilak Stade between MP 105 and MP 111. The Skilak Stade drainage is essentially the modern channel of the Kasilof River.

During the Killey Stade, ancestral Crooked Creek built a braided delta northwestward into ancestral Cook Inlet. The Killey aged braided outwash flowed into the braided delta in the area near the intersection of Coho Loop Road and the Sterling Highway (MP 111) with buried stagnant masses of late Moosehorn ice creating a pitted outwash plain as evidenced by the numerous kettle lakes south of MP 111 to the end of this section of highway.

Glacial outwash consisted of interlayered sand and gravel. Alluvial deposits are primarily composed of stream terraces above the stream floodplains consisting of sand and gravel. Most of the past and present material sites have been on these glaciofluvial deposits.

3.7 Clam Gulch to Anchor Point MP 117 to MP 157

Between MP 117 and MP 157, the highway crosses glaciolacustrine deposits near the eastern shore of Cook Inlet. This area was reportedly glaciated during pre-Naptowne events. Glaciolacustrine deposits were deposited during advance of the Moosehorn Stade when a regional lake formed between Caribou Hills and the massive ice sheet that advanced eastward from the west side of Cook Inlet covering much of the southern Kenai Peninsula lowlands. After the extent of the Moosehorn Stade, the glacier dam thinned and the lake began to drain through braided and meandering streams which cut into the glaciolacustrine deposits in response to isostatic rebound.

The glaciolacustrine material is well sorted and well stratified layers of clay, silt, and fine sands overlain by sand and gravels. Glaciofluvial deposits in the area are predominated by sand and gravel. Weakly lithified sandstone of the Sterling Formation outcrops along the coast south of Clam Gulch. Surficial deposits overlying the sandstone make mining this rock very difficult. Most sites, past and present, are located on either glaciofluvial outwash or stream terraces.

There was only one laboratory test result found for material in this section and it came from MS 21-1-262-1 near MP 144. The results show a Los Angeles Abrasion loss of 14 percent, a degradation value of 74 and NaSO₄ loss result of 0 percent.

3.8 Anchor Point to End of Homer Spit MP 157 to MP 179.5

Starting at MP 157 the highway follows the Anchor River, onto an inactive floodplain, and then follows the river southeast until it climbs onto a moraine of Moosehorn age after MP 161. The moraine controls the flow of the Anchor River to the northeast. This section of highway ends at a wave-washed terrace where the highway crosses the Anchor River at MP 161. Between MP 161 and MP 179.5, the road follows the Anchor River; descends into Homer along the side of Diamond Ridge; and then runs out to the end of the Homer Spit; ending at the Ferry Dock.

Between MP 161 and Diamond Creek at MP 167 the highway traverses an old meltwater drainage channel formed between Moosehorn Stade glaciers that filled Kachemak Bay and the bed-rock ridge. There are several commercial gravel pits on the glaciofluvial deposits along this old channel, some of which were originally DOT&PF sites.

For the first 4 miles, to ~ MP 165 the highway parallels the south side of the Anchor River floodplain. DOT&PF has two sites in the floodplain but they are on the far side of the river from the highway and have not been developed. The alluvial deposits consist of sand and gravel.

The descent into Homer from MP 167 to MP 174 is characterized by extensive colluvial fans emanating from the steep canyons and gullies of the Beluga Formation above the highway. The City of Homer lies on glaciolacustrine deposits consisting of clay and silt and in places covered with coluvium. There apparently were no material sites mined in this section although several areas were investigated and given material site numbers by DOT&PF.

At MP 174 the highway traverses onto the Homer Spit a long gravel spit stretching out into Kachemak Bay. The spit was formed on a submarine terminal moraine complex of the Kachemak Bay Lobe. The spit is composed of sand and gravel. Material has been excavated from the spit in the past. Due to erosion along the spit and the value of land on the spit, it is unlikely that future excavation will occur on the spit.

3.9 East End Road and Ohlson Mountain Road

East End Road traverses glacial tills of the Killey Stade overlying weakly lithified sandstone and mudstone of the Miocene Beluga Formation. Several currently closed sites, developed on East End Road by DOT&PF in the past were on small deposits of apparently fluvial material that were quickly exhausted. Material has been brought in from the other side of Homer in the past. It appears that unless one can locate isolated patches of glaciofluvial fluvial material, the only nearby material sources lie within the Fox River Delta which is a protected area that is difficult to mine. If roads are extended to the north from East End Road into the upper Deep Creek drainage, new sources of material similar to the Mount Ohlson Mountain Site may be located.

Ohlson Mountain Road traverses weakly lithified massive sandstone of the Sterling Formation and glacial deposits of the older Knik Glaciation which are exposed on the last section of the road. The Ohlson Mountain Site, MS 430-625-1, appears to be in a remnant of glaciofluvial material perched on top of the mountain. There are almost no aggregate testing results for material from Ohlson Mountain. Laboratory test results from MS 430-625-1 on Ohlson Mountain show a Los Angeles Abrasion loss of 17 percent and degradation values of 15 to 37 percent. This indicates the material may produce inadequate material for crushed aggregate such as D-1 or asphalt aggregate.

4.0 LAND USE PLANNING

State lands along the Sterling Highway are being managed by the State of Alaska Department of Natural Resources (DNR) under the Kenai Area Plan.

The Kenai Area Plan was adopted in 2001. The Kenai Area Plan manages state uplands, tide-lands, and submerged lands within the planning boundary. This area includes the majority of the Kenai Peninsula, bounded on the north by Turnagain Arm, where plan boundaries contact boundaries of the Turnagain Arm Management Plan and the Susitna Area Plan. The Plan is bounded to the east by Prince William Sound Area Plan. The Kenai Area Plan area includes some state lands on the west side of Cook Inlet, where it contacts the Bristol Bay Area Plan.

The complete plan is available on the internet at the following address:

<http://dnr.alaska.gov/mlw/planning/areaplans/kenai/>

The following excerpts from the plan are directly relevant to material sources.

Pursuant to *Alaska Department of Natural Resources, Division of Mining, Land & Water, Planning, Area Plan, Kenai Area Plan, Chapter 2 (adopted January 7, 2000)* is as follows:

Goals

The following goals are for state lands in the planning area. Goals are general conditions that DNR attempts to achieve through management actions. The goals are listed alphabetically. No single goal has a priority over the others.

Economic Development. Provide opportunities for jobs and income by managing state land and resources to support a vital, self-sustaining local economy.

Fiscal Costs. Minimize the needs for and the fiscal cost of providing government services and facilities, such as schools and roads. Locate settlement uses where there is a sustainable economic base and where necessary services can be efficiently provided.

Public Health and Safety. Maintain or enhance public health and safety for users of state land and resources.

Public Use. Provide and enhance diverse opportunities for public use of state lands, including uses such as hunting, fishing, boating, and other types of recreation.

Quality of Life. Maintain or enhance the quality and diversity of the natural environment, including air, land and water, and fish and wildlife habitat and harvest opportunities; and protect heritage resources and the character and lifestyle of the community.

Settlement. Provide opportunities for private ownership and leasing of land currently owned by the state.

Sustained Yield. Maintain the long-term productivity and quality of renewable resources and all other state-owned replenish able resources on a sustained-yield or optimum-sustained-yield basis, including fish, wildlife, rangelands and forests.

Management Intent

Management intent for state land is based on a resource and use inventory, information on existing and potential trends, current and pending authorizations, plans in place now, and public participation. The planning process included a consideration of alternatives. Public and agency comments on these alternatives and the 1994 draft plan were analyzed. In addition, considerable additional research was conducted on each parcel between 1994 and 1998. The planning team discussed this information in 1998 and extensive changes to the 1994 draft were made including an extensive reformatting of the plan and its policies, guidelines, and management intents. The public and agencies again reviewed these changes in late 1999 and early 2000. In response, DNR made additional changes to the plan prior to its adoption.

General Framework of the Plan

A. State land within the planning area will be managed to allow for multiple use unless legislatively designated or a parcel of state land is less than 640 acres and managed under a management agreement by another state agency.

B. State land will also be managed to protect access (except when it is determined that access may be detrimental to a resource, such as brown bears) and public resources.

Types of resources to be protected include, but are not limited to, habitat, recreation, water quality, watersheds, scenery, wilderness, and trails.

C. State land will remain open to mineral entry unless specifically closed.

D. Activities and authorizations identified in units as “designated uses” may take precedence over other uses that are authorized subsequent to designation. Although some uses are designated, other uses may still be allowed in a given unit. These other uses may be authorized if they are not incompatible with the primary uses or resources for which a unit is designated. This plan emphasizes minimizing land use conflicts through plan guidelines and intent rather than through prohibitions. However, if DNR determines that a proposed use is incompatible with the designated use, the proposed use shall not be authorized or it shall be modified so that the incompatibility no longer exists.

E. This plan designates state lands in categories that are generally consistent with current use patterns and the most significant resources in the planning area.

Guidelines by Activity or Resource Value

The following guidelines are specific directives that will be applied to management decisions.

DNR will use these guidelines when considering issuing authorizations and conveyances or making management decisions on state land. These guidelines will also apply to lands that are currently state selected and topfiled when they are tentatively approved or patented into state ownership.

Chapter 2 guidelines apply to all state land covered by the Kenai Area Plan unless the plan explicitly exempts units or designations from a guideline or the resource or use for which a guideline is intended does not exist in the unit in question.

General

A. All authorizations for use of state land within the planning area will be consistent with the management intent in this plan.

B. In considering authorizations for use of state land, DNR will adjudicate applications to:

1. minimize damage to streambeds, fish and wildlife habitat, vegetation, trails, and other resources;
2. minimize conflicts between resources and uses; and
3. protect the long-term value of the resource, public safety, and the environment.

C. If authorizations from other agencies are required, DNR will consider issuing a permit or lease contingent upon issuance of these other authorizations.

Other State Land

Parcels that are donated or acquired after the plan is adopted will be designated for the uses for which they were acquired or donated without an amendment to the plan. Lands that come into state ownership through other means will be classified after consultation with ADFG.

Also pursuant to *Alaska Department of Natural Resources, Division of Mining, Land & Water, Planning, Area Plan, Kenai Area Plan, Chapter 2-32: Materials (adopted January 7, 2000)*, reads as follows:

MATERIALS

Goals

Land for state-owned materials sites. Maintain suitably located material sites in state ownership and make them available to public and private users to economically meet the area's long-term need for materials. Many of these sites are already owned by the Department of Transportation and Public Facilities or managed by them under Interagency Land Management Assignments issued by DNR.

Management Guidelines

A. Materials Land Management. On land designated Materials, the priority is to manage the unit to allow exploration and development of sand, gravel, and other materials. Developing material sites is a high priority.

B. Materials Site List. The units designated Materials in this plan do not encompass all lands with materials potential owned by DNR and DOT&PF. Materials designations are based on information that was available at the time the plan was developed. As more information becomes available, new sites may be identified and may be re-designated Materials through a "Minor Change" to the plan consistent with 11 AAC 55.030.

C. Applications for Uses of Material Land. DOT&PF will be consulted when reviewing applications on lands that are identified as containing materials in this plan. Materials sites that are still needed by DOT&PF for materials extraction, materials storage, public facilities, and other transportation-related uses will be retained in state ownership.

D. Activities in Wetlands. DNR may authorize materials removal and other activities in wetlands, including construction of roads and pads, if DNR determines that the proposed activity will not cause significant adverse impacts to important fish and wildlife habitat or important ecological processes, a feasible and prudent alternative does not exist, and it is in the state's best interest.

Materials removal from wetlands, lakes, or stream corridors (including active and inactive floodplains) should occur only after design consultation with the Department of Fish and Game, the Department of Environmental Conservation, and the Kenai Peninsula Borough. A Title 16 Permit may be required from ADFG in fish-bearing waters. Dredging and filling activities require a U.S. Army Corps of Engineers Section 404 Permit.

E. Maintain Other Uses and Resources. Before materials are extracted, DNR will ensure that requirements of the material sale contract adequately protect other important resources and uses, such as existing water rights, water resource quantity and quality, navigation, fish and wildlife habitat and harvest, commercial forest resources, recreation resources and uses, heritage resources, adjacent land uses, scenic resources, and access to public or private lands.

DNR should determine if other existing material sites could be vacated and rehabilitated as a result of opening a new material site. The disposal of materials should be consistent with the applicable management intent statement for the unit and management guidelines in the plan.

F. Land Offerings in Areas of High Materials Potential. Generally, if a unit is designated Settlement but contains sand and gravel deposits, rock sources, or other similar, high-value materials resources, a pit area will be identified and retained in public ownership for future use before lands are offered for sale.

G. Screening Materials Sites. Material sites will, where feasible and prudent, be screened from roads, residential areas, recreational areas, and other areas of significant human use. Sufficient land will, where feasible and prudent, be allocated to the materials site to allow for such screening.

Resource Allocation Summary

Regional and local demand for materials is high on the Kenai Peninsula because of the extensive road network. Acre-for-acre, material sites are some of the highest value land the state owns in the planning area. In areas where materials are not located on state lands, costs for publicly funded projects can increase dramatically because of the cost of shipping or purchase from nonstate sources. Even though this plan designates 28 sites Materials (approximately 1,300 acres), there is a limited supply of materials on state land. As a result, with few exceptions, all known materials sites are designated Materials and are to be managed for this and related transportation uses. Exceptions are units where DOT&PF has determined that the site is no longer needed. In one instance, an entire river, the Resurrection, includes management intent to allow for extraction not only for construction projects, but also to reduce danger of flooding. For some sites the plan recommends future use of the site such as conveyance to a municipality or for a future community or commercial center. Some of the units that are not already under DOT&PF management are recommended for it. See Chapter 4, Table 4.8 for a list of these sites.

From Chapter 4
Table 4.8 Proposed Interagency Land Management Assignments (ILMA's)
with other State Agencies

Unit #	Region	Name of Unit	Acreage	Agency
106G	6	Crooked Creek State Fish Hatchery	10	ADFG
68C	7	Materials site on Sterling Hwy adjacent to Deep Creek Knoll	1	DOT&PF
117C	6	Materials site at junction of E. Cohoe Loop & Edmonds Roads	37	DOT&PF
118	6	K. Beach Rd. Mile 8-10, four parcels	44	DOT&PF
133	5	Gravel pits, Sterling Hwy Mile 86.7	80	DOT&PF
188	9	Gray Cliff north of Seldovia	12	DOT&PF
192	9	Port Graham airstrip	31	DOT&PF
227	7	Homer DOT&PF Maintenance Facility	5	DOT&PF
241	7	DOT&PF misc. use site on Old Sterling Hwy. SE of Anchor Point	80	DOT&PF
253A	7	Materials source at Mi 162 Sterling Hwy. 5 miles S. of Anchor	10	DOT&PF
276B	8	Upper Swift Creek materials site, end of Eagle Lake Road	40	DOT&PF
284	1	Sunrise South - east side of Hope Highway	34	ADFG
291	1	Bear Creek Materials Site, Hope	60	DOT&PF
323	7	DOTPF site south of Happy Valley Road junction on Sterling	40	DOT&PF
357	3	Spur Ridge west of Lowell Point; former rock quarry	252	DOT&PF
380B	2	North end Lawing Airstrip; existing material site	46	DOT&PF
382G	2	Lawing Airstrip, S. of Crown Point on Seward Highway	21	DOT&PF
399	4	DOTPF materials site at Quartz Creek airstrip	22	DOT&PF
408A	4	Potential material site at Mi 40 Sterling Hwy. 200' north of	87	DOT&PF
409A	4	Upper Quartz Creek materials site	43	DOT&PF
410A	2	Canyon Creek materials site at Mi. 48.5 of Seward Hwy. on	5	DOT&PF
410B	2	Lower Summit Lake materials site	17	DOT&PF
		Total	977	

5.0 RELEVANT PUBLICATIONS

The following is a list of publications that may be useful for understanding the geology and material sources in the Sterling Highway area. (Note: references pertaining specifically to the Kenai, Seldovia, Seward and Tyonek Quadrangles appear under the quadrangle listing; references including these quadrangles plus other portions of the greater area appear in the “Alignment-wide” section and statewide references appear in the “Statewide” section).

Kenai Quadrangle: A-1 thru A-5, B-1 thru B-5, C-1 thru C-4, and D-1 thru D-4

Barnes, F.F., and Cobb, E.H., 1959, Geology and coal resources of the Homer district, Kenai coal field, Alaska: U.S. Geological Survey Bulletin 1058-F, p. 217-260, 11 sheets, scale 1:2,400.

Bradley, D.C., and Wilson, F.H., 2000, Reconnaissance bedrock geology of the southeastern part of the Kenai Quadrangle, Alaska, in Kelley, K.D., and Gough, L.P., ed., Geologic studies in Alaska by the U. S. Geological Survey, 1998: U.S. Geological Survey Professional Paper 1615, p. 59-63.

Capps, S.R., 1916, The Turnagain-Knik region, in U.S. Geological Survey, Mineral resources of Alaska, report on progress of investigations in 1915: U.S. Geological Survey Bulletin 642, p. 147-194.

Hartman, D.C., Pessel, G.H., and McGee, D.L., 1974, Stratigraphy of the Kenai group, Cook Inlet: Alaska Division of Geological & Geophysical Surveys Alaska Open-File Report 49, 7 p., 11 sheets, scale 1:500,000. doi:[10.14509/149](https://doi.org/10.14509/149)

Karlstrom, T.N.V., 1957, Ground conditions and surficial geology of the Kenai-Kasilof area, Kenai Peninsula, south-central Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map 269, 1 sheet, scale 1:63,360.

Rawlinson, S.E., 1986, Peat resource and surficial geologic map of the south Kenai area, Kenai Peninsula, Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 86-14, 1 sheet, scale 1:31,680. doi:[10.14509/1189](https://doi.org/10.14509/1189)

Reger, R.D., 1977, Photointerpretive map of the surficial geology of the southern Kenai lowlands: Alaska Division of Geological & Geophysical Surveys Alaska Open-File Report 111A, 1 sheet, scale 1:63,360. doi:[10.14509/24](https://doi.org/10.14509/24)

Reger, R.D., and Carver, C.L., 1977, Photointerpretive map of the geologic materials of the southern Kenai lowlands: Alaska Division of Geological & Geophysical Surveys Alaska Open-File Report 111B, 1 sheet, scale 1:63,360. doi:[10.14509/25](https://doi.org/10.14509/25)

Reger, R.D., Sturmman, A.G., Berg, E.E., and Burns, P.A.C., 2007, A guide to the late Quaternary history of northern and western Kenai Peninsula, Alaska: Alaska Division of Geo-

logical & Geophysical Surveys Guidebook 8, 112 p., 6 sheets, scale 1:63,360. doi:[10.14509/15941](https://doi.org/10.14509/15941)

Seldovia Quadrangle: A-3 thru A-6, B-1 thru B-6, C-1 thru C-5, and D-1 thru D-5

- Ager, T.A., 2000, Postglacial vegetation history of the Kachemak Bay area, Cook Inlet, south-central Alaska, in Kelley, K.D., and Gough, L.P., ed., *Geologic studies in Alaska by the U. S. Geological Survey*, 1998: U.S. Geological Survey Professional Paper 1615, p. 147-165.
- Bradley, D.C., and Kusky, T.M., 1992, Deformation history of the McHugh Complex, Seldovia Quadrangle, south-central Alaska, in Bradley, D.C., and Ford, A.B., ed., *Geologic studies in Alaska by the U.S. Geological Survey*, 1990: U.S. Geological Survey Bulletin 1999, p. 17-32.
- Bradley, D.C., Kusky, T.M., Haeussler, P.J., Karl, S.M., and Donley, D.T., 1999, Geologic map of the Seldovia Quadrangle, south-central Alaska: U.S. Geological Survey Open-File Report 99-18, 1 sheet.
- Kelley, J.S., 1984, Geologic map and sections of the southwestern Kenai Peninsula west of the Port Graham Fault, Alaska: U.S. Geological Survey Open-File Report 84-152, 1 sheet, scale 1:63,360.
- LePain, D.L., ed., 2009, Preliminary results of recent geologic investigations in the Homer-Kachemak Bay area, Cook Inlet Basin: Progress during the 2006-2007 field season: Alaska Division of Geological & Geophysical Surveys Preliminary Interpretive Report 2009-8, 187 p. doi:[10.14509/20161](https://doi.org/10.14509/20161)
- Newberry, R.J., Burns, L.E., and Pessel, G.H., 1985, Preliminary report - geology of the Red Mountain ultramafic complex, Seldovia, Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 85-39, 2 p. doi:[10.14509/1132](https://doi.org/10.14509/1132)
- Reger, R.D., and Carver, C.L., 1977, Photointerpretive map of the geologic materials of the southern Kenai lowlands: Alaska Division of Geological & Geophysical Surveys Alaska Open-File Report 111B, 1 sheet, scale 1:63,360. doi:[10.14509/25](https://doi.org/10.14509/25)
- Reger, R.D., and Petrik, W.A., 1993, Surficial geology and late Pleistocene history of the Anchor Point area, Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 93-50B, 9 p., 1 sheet, scale 1:25,000. doi:[10.14509/1610](https://doi.org/10.14509/1610)
- Riehle, J.R., 1977, Airphoto interpretation and surficial geology of upper Kachemak Bay-English Bay area, Alaska: Alaska Division of Geological & Geophysical Surveys Alaska Open-File Report 110, 1 sheet, scale 1:63,360. doi:[10.14509/23](https://doi.org/10.14509/23)

Waller, R.M., Feulner, A.J., and Morris, D.A., 1968, Water resources and surficial geology of the Homer area, south-central Alaska: U.S. Geological Survey Hydrologic Investigations Atlas 187, 1 sheet, scale 1:63,360.

Seward Quadrangle: B-7, B-8, C-7 and D-8

Dumoulin, J.A., 1987, Sandstone composition of the Valdez and Orca groups, Prince William Sound, Alaska: U.S. Geological Survey Bulletin 1774, 37 p.

Nelson, S.W., Dumoulin, J.A., and Miller, M.L., 1985, Geologic map of the Chugach National Forest, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map 1645-B, 16 p., 1 sheet, scale 1:250,000.

Nelson, S.W., Miller, M.L., Haeussler, P.J., Snee, L.W., Phillips, P.J., and Huber, Carol, 1999, Preliminary geologic map of the Chugach National Forest special study area, Alaska: U.S. Geological Survey Open-File Report 99-362, 1 sheet.

Tuck, Ralph, 1933, The Moose Pass-Hope district, Kenai Peninsula, Alaska: U.S. Geological Survey Bulletin 849-I, p. 469-530.

Tysdal, R.G., and Case, J.E., 1979, Geologic map of the Seward and Blying Sound quadrangles, Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map 1150, 12 p., 1 sheet, scale 1:250,000.

Alignment-wide

Karlstrom, T.N.V., 1964, Quaternary geology of the Kenai Lowland and glacial history of the Cook Inlet region, Alaska: U.S. Geological Survey Professional Paper 443, 69 p., 7 sheets, scale 1:63,360.

Martin, G.C., Johnson, B.L., and Grant, U.S., 1915, Geology and mineral resources of Kenai Peninsula, Alaska: U.S. Geological Survey Bulletin 587, 243 p., 4 sheets, scale 1:62,500. Péwé, T.L., 1975, Quaternary geology of Alaska: U.S. Geological Survey Professional Paper 835, 145 p., 3 plates.

Reger, R.D., Sturmman, A.G., Berg, E.E., and Burns, P.A.C., 2007, A guide to the late Quaternary history of northern and western Kenai Peninsula, Alaska: Alaska Division of Geological & Geophysical Surveys Guidebook 8, 112 p., 6 sheets, scale 1:63,360. doi:[10.14509/15941](https://doi.org/10.14509/15941)

Wilson, F.H., Hults, C.P., Labay, K.A., and Shew, Nora, 2008, Preliminary integrated geologic map databases for the United States: digital data for the reconnaissance geologic map for

Prince William Sound and the Kenai Peninsula, Alaska: U.S. Geological Survey Open-File Report 2008-1002.

Wilson, F.H., Hults, C.P., Schmoll, H.R., Haeussler, P.J., Schmidt, J.M., Yehle, L.A., and Labay, K.A., 2012, Geologic map of the Cook Inlet region, Alaska, including parts of the Talkeetna, Talkeetna Mountains, Tyonek, Anchorage, Lake Clark, Kenai, Seward, Iliamna, Seldovia, Mount Katmai, and Afognak: U.S. Geological Survey Scientific Investigations Map 3153, 76 p., 2 sheets, scale 1:250,000.

Statewide

Brown, J., Ferrians, O. J., Heginbottom, J. A., and Melnikov, E. S., 1997, Circum-Arctic map of permafrost and ground-ice conditions: U.S. Geological Survey Circum-Pacific Map, 1map, scale 1:10,000,000.

Coulter, H. W., Hopkins, D. M., Karlstrom, T. N. V., Péwé, T. L., Wahrhaftig, C., and Williams, J. R., 1965, Map showing extent of glaciations in Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-415, 1 map, scale 1:2,500,000.

Ferrians, O. J. (comp.), 1965, Permafrost map of Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-445, 1 map, scale 1:2,500,000.

Gallant, A. L., Binnian, E. F., Omernik, J. M., and Shasby, M. B., 1995, Ecoregions of Alaska: U.S. Geological Survey Professional Paper Report Number 1567, 73 p. 1 map, scale 1:5,000,000.

Hamilton, T.D., Reed K.M., Thorson, R.M., 1986, Glaciation in Alaska, the geologic record. Alaska Geological Society, p. 265.

Jones, D.L., Silberling, N. J., Berg, H. C., and Packer, G., 1981, Map showing tectonostratigraphic terranes of Alaska, columnar sections, and summary description of terranes: U.S. Geological Survey Open File Report 81-792, 21 p., 1 sheet.

Karlstrom, T.N.V., et al., 1964, Surficial geology of Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-357, scale 1:584,000.

Nokleberg, W.J., Plafker, George, and Wilson, F.H., 1994, Geology of south-central Alaska, in Plafker, George, and Berg, H.C., ed., The Geology of Alaska: Geological Society of America, p. 311-364.

Péwé, T.L., 1975, Quaternary geology of Alaska: U.S. Geological Survey Professional Paper 835, 145 p., 3 plates.

Plafker, George, Moore, J.C., and Winkler, G.R., 1994, Geology of the southern Alaska margin, in Plafker, George, and Berg, H.C., ed., The Geology of Alaska: Geological Society of America, p. 389-448.

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- Reger, R.D., 1987, Survey of the sand-and-gravel potential of legislatively designated replacement pool lands in Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 88-2, 18 p., 227 sheets, scale 1:63,360.
- Reger, R.D., 1988, Status of geologic data for active material sites on mental health grant (trust) lands in Alaska: Alaska Division of Geological & Geophysical Surveys Public Data File 88-20, 54 p., 23 sheets, scale 1:63,360.
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- Schmoll, H.,R., Yehle, L.,A., Gardner, C., A., Odum, J.,O.,1984, Guide to Surficial Geology and Glacial Stratigraphy in the Upper Cook Inlet Basin. Alaska Geological Society, p. 89.